amendments and the following remarks is respectfully requested.

Claim 3 stands rejected under 35 U.S.C. §102(e) as anticipated by U.S. Patent No. 6,258,617 B1 to Nitta et al. (hereinafter, Nitta).

Claims 1 and 4-6 stand rejected under 35 U.S.C. §103(a) over Nitta in view of U.S. Patent No. 6,046,464 to Schetzina. Claims 1 and 4-6 stand rejected stand rejected under 35 U.S.C. §103(a) over Nitta in view of U.S. Patent No. 6,072,189 to Duggan

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

The claimed invention, as described in claim 1, is directed to *inter alia* a group III nitride compound semiconductor device of a successively laminated structure that includes a substrate, a buffer layer, a first layer formed of $\underline{In_XGa_{1-X}N}$ ($0<X<1$), and a second layer formed of InYGa1-YN ($0<Y<1$, $Y \neq X$), in which a composition ratio of In in the first layer is changed continuously or intermittently in a direction toward the second layer side from the buffer layer side so that a composition of the first layer in a face brought into contact with the second layer becomes substantially equal to a composition of the second layer, and in which the buffer layer is deposited between and in direct contact with both the substrate and the first layer, and the first layer is disposed between and in direct contact with both the buffer layer and the second layer.

The claimed invention, as described in claim 3, is directed to *inter alia* a group III nitride compound semiconductor device of a successively laminated structure that includes a substrate, a buffer layer, a first layer formed of $\underline{Al_aGa_bIn_{1-a-b}N}$ (0,a,1, 0,b,1, a+b,1), and a second layer formed of $In_YGa_{1-Y}N$ ($0<Y<1$), in which the buffer layer is disposed between and in direct contact with both the substrate and the first layer, and the first layer is disposed between and in direct contact with both the buffer layer and the second layer, and in which a composition ratio of Al and In in the first layer is changed continuously or intermittently in a direction toward the second layer side from the buffer layer side so that a lattice constant of the first layer in a face brought into contact with the second layer becomes substantially equal to a lattice constant of the second layer.

An aspect of the present invention allows control of band gaps by changing the composition ratio of Al and In. Another aspect of the present invention allows improved crystallinities of the layers by constructing the first layer with $IN_XGa_{1-X}N$ ($0<X<1$) and the buffer layer $Al_XGa_{1-X}N$ ($0 <= X <= 1$).

II. THE PRIOR ART REJECTIONS

The §102(e) rejection of claim 3 is rendered moot by the incorporation of the subject matter of claim 4 into claim 3.

A. The Nitta Reference

Nitta discloses a gallium-nitride-based compound semiconductor blue light emitting diode 1 that has a sapphire substrate 100 (col. 2, lines 63-64). On the substrate 100, a gallium-nitride-based semiconductor buffer layer 101 and a gallium-nitride-based n-type semiconductor contact layer 102 are formed (col2, line 66 to col. 3, line 3). On layer 102, a gallium-nitride-based n-type semiconductor clad layer 103, a gallium-nitride-based semiconductor active layer 104, a gallium-nitride-based p-type semiconductor clad layer 105, and a gallium-nitride-based p-type semiconductor contact layer 106 are formed (col. 3, lines 3-8).

B. The Schetzina Reference

To make up for the deficiencies of Nitta, the Examiner relies on Schetzina. However, Schetzina fails to do so.

With regard to Figs. 9A-C, Schetzina discloses Group II-V nitrides materials are grown on multilayer substrates such as sapphire or SiC by first depositing a nitride buffer layer, such as, an AlN, an $Al_{1-y}Ga_yN$, or a GaN buffer layer onto the substrate to improve the nucleation and subsequent growth of the Group III-V nitride materials (col. 14, line 60 to col. 15, line 1).

Claims 1 and 3 recite at least the feature of "a first layer formed of $Al_aGa_bIn_{1-a-b}N$."

Nitta teaches a gallium-nitride-based semiconductor buffer layer. Schetzina does not cure the deficiencies of Schetzina, because Schetzina merely teaches a 3-element system, whereas the

present invention discloses a 4-element system, that is, "a first layer formed of $Al_aGa_bIn_{1-a-b}N$." Therefore, Schetzina fails to teach or suggest the feature of a 4-element system, that is, "a first layer formed of $Al_aGa_bIn_{1-a-b}N$" as required by in claims 1 and 3.

In addition, the present invention is distinguished by the changing composition ratio of Al and In, by which band gaps are controlled (Specification, page 6, line 27 to page 7, line 3).

Further, the crystallinities of the layers are improved by constructing the first layer with $In_XGa_{1-X}N$ ($0<X<1$) and the buffer layer $Al_XGa_{1-X}N$ ($0<= X <=1$).

Thus, Schetzina does not cure the deficiencies of Nitta. Nowhere does Schetzina teach or suggest a 4-element system that continuously or intermittently changes a composition ratio of Al and In in the first layer. Applicant respectfully submits that Nitta and Schetzina either individually or in combination fail to teach or suggest every feature of independent claims 1 and 3.

Accordingly, Nitta and Schetzina either individually or in combination fail to render obvious the subject matter of claims 1 and 3 and claims 5 and 6, which depend on claim 3, under 35 U.S.C. §103(a). By this Amendment, claim 4 is canceled; hence, the rejection of claim 4 is moot. Withdrawal of the rejection of claims 1 and 4-6 as unpatentable over Nitta in view of Schetzina is respectfully solicited.

C. The Duggan Reference

Further, in the additional prior art rejection, the Examiner relies on Duggan to make up for the deficiencies of Nitta. However, Nitta fails to do so.

Fig. 7 is a schematic diagram of a light-emitting diode structure having the same constituent layers as the structure of Fig. 1, but with the introduction of graded layers 41, 42, 43 and 44 at the interfaces between the (AlGa)N cladding layers 4 and 6 and both the GaN contact layers 3 and 7 and the (InGa)N active layer 5.

Claims 1 and 3 recite at least the features of "a first layer formed of $Al_aGa_bIn_{1-a-b}N$ ... wherein a composition ratio of In in the first layer is changed continuously or intermittently in a direction toward the second layer side from the buffer layer side so that a composition of the first

layer in a face brought into contact with the second layer becomes substantially equal to a composition of the second layer" and "a first layer formed of $Al_aGa_bIn_{1-a-b}N$... wherein a composition ratio of Al and In in said first layer is changed continuously or intermittently in a direction toward the second layer side from the buffer layer side so that a lattice constant of said first layer in a face brought into contact with said second layer becomes substantially equal to a lattice constant of said second layer," respectively.

Duggan merely teaches a 3-element system, whereas the present invention discloses a 4-element system, that is, "a first layer formed of $Al_aGa_bIn_{1-a-b}N$." Therefore, Duggan fails to teach or suggest the feature of a 4-element system, that is, "a first layer formed of $Al_aGa_bIn_{1-a-b}N$" as recited in claims 1 and 3.

In addition, the present invention is distinguished by the changing composition ratio of Al and In, by which band gaps are controlled (Specification, page 6, line 27 to page 7, line 3).

Further, the crystallinities of the layers are improved by constructing the first layer with $In_XGa_{1-X}N$ ($0<X<1$) and the buffer layer $Al_XGa_{1-X}N$ ($0<= X <=1$).

Duggan does not cure the deficiencies of Nitta. Nowhere does Duggan teach or suggest a 4-element system that continuously or intermittently changes a composition ratio of Al and In in the first layer. Applicant respectfully submits that Nitta and Duggan either individually or in combination fail to teach or suggest every feature of claims 1 and 3. Accordingly, Nitta and Duggan either individually or in combination fail to render obvious the subject matter of claims 1 and 3 and claims 5 and 6, which depend on claim 3, under 35 U.S.C. §103(a). By this Amendment, claim 4 is canceled; hence, the rejection of claim 4 is moot. Withdrawal of the rejection of claims 1 and 4-6 as unpatentable over Nitta in view of Duggan is respectfully solicited.

III. CONCLUSION

In view of the foregoing, Applicant submits that claims 1, 3, and 5-8 all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to

issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview. The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 12/13/02

Peter A. Balnave
Reg. No. 46,199

McGinn & Gibb, PLLC
8321 Old Courthouse Road
Vienna, Virginia 22182-3817
(703) 761-4100
Customer No. 21254